schedule E analysis

Sudbury Area Planning Study

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OF

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CAUTION

It is emphasized that this analysis is intended merely as an example of the application of the Sudbury Area Planning Study technique. The results reflect certain value judgments which had to be introduced to demonstrate its application. Subsequent users should expect to apply their own value judgments and quite possibly arrive at different results.

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INTRODUCTION

1. Background

The basic objective of the main exercise in the Sudbury Area Planning Study is to devise a tool to assist in locating the best land for future urban development in the area centered on Sudbury.

The Sudbury Area Planning Study first assembled a large inventory of planning information relating to a Study Area encompassing an area several times the size of the Regional Municipality. Schedule "A" provided background data relating to the future demand for urban land: economic prospects, future employment opportunities, population projections, housing and land requirements. Schedule "B" assembled basic engineering, planning and environmental data relevant to urban development. The suitability of land for urban development is determined by the total of all its characteristics which can be described either as positive features or as constraints. It is common to think in terms of the "costs" of development and in Schedule "C" the inventory information was translated into constraint information, whereby the relative costs of developing each part of the Study Area were illustrated in map form.(1) These costs included non-quantifiable environmental consideration as well as quantifiable engineering costs.

A computer program was used to store the information and aggregate it to permit consideration of the effect of all or any number of constraints at one time, with each constraint "weighted" to reflect its relative importance in the opinion of the user. The program is described in detail in Schedule "D".

2. A suggested process for analysis

Refined to its ultimate potential, the technique developed in this Study could theoretically be used to produce, in one operation, a single composite map showing the best land for urban development in the Study Area. In practice it is more realistic and indeed more

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(1) A list of all the constraint maps with their ratings is contained in the appendix.

useful to use the technique as a tool for step by step analysis. The practical goal may still be to find the "best" development land but a better understanding may be gained by viewing the exercise as a process, whereby the logical consequences of certain subjective judgments may be examined.

No doubt, using the same basic technique and data, many alternative approaches to the final result are possible. The following is a description of the process which seemed most useful to the Study Staff and which is presented as an example.

The constraint information assembled for this study comprises a large variety of different types of information. Engineering information lends itself relatively easily to a somewhat objective comparison because various engineering facts can usually be reduced to a common denominator: cost, expressed in dollars and cents. This material was deemed basic as the first step of the analysis.

It was quickly ascertained that the Environmental Composite comprising Wildlife, Scenic, Recreation, Vegetation and Fisheries information did not conflict substantially with the basic Engineering Composite. This led to a decision to use the Environmental Composite for an environmental sensitivity check after indications of basic development priority areas had been determined from combinations of other maps.

Of the four remaining constraint maps, Aircraft Noise only affects a small area and Air Pollution, since the introduction of the high stack, seems not to warrant a heavy weight; both may therefore be added to the basic engineering composite without causing a very significant change in the resultant pattern. The Agricultural Capability and Groundwater maps, on the other hand, affect large areas of land which are otherwise relatively free of constraints. The decision to emphasize or de-emphasize one or both of these maps will cause the greatest variation in

possible development patterns. The focus of the analysis of alternatives has therefore been directed to the effect of these two constraints on the Composite.

In order to simplify the process of arriving at a decision by the user with respect to the weights to be adopted for the various constraints, three basic steps are proposed:

- firstly, the eight maps produced by the engineering consultants are combined and appropriate weights chosen;
- secondly, the four maps assembled by the planners are added to the basic engineering composite and their weights are determined, and
- thirdly, the resultant composite is tested for environmental sensitivity, using the composite of maps assembled by the environmental consultants.

Certain other important constraints are of a nature that imposes a special treatment. Land that is already developed, as shown on the existing land use map, must as a general rule be considered unavailable and therefore totally constrained.(1) Land in the flood plain may initially be viewed in the same manner, with a subsequent review of areas that are already partially developed and that may be capable of being protected from flooding. Land tenure may also be a form of constraint which should be examined when the choice has been narrowed down.

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(1) It is possible to conceive of exceptions such as worked-out gravel pits.

COMPOSITION AND WEIGHTING OF COMPOSITE 1

As a first step in the process, a number of engineering constraint maps were combined, with appropriate weights, to produce an Engineering Composite. This composite was comprised of the constraint information shown on Table A-A.

TABLE A-A
COMPOSITION AND WEIGHTING OF COMPOSITE 1 (1)

Constraint Maps	Relative Weight (Weight Set 1)
Local Services	2.0
Water Supply Systems	0.6
Sewage Disposal Systems	0.6
Accessibility to Copper Cliff-Creighton	0.32
Accessibility to Falconbridge Garson	0.11
Accessibility to Levack-Onaping	0.11
Accessibility to Sudbury	0.86
Highway Construction Cost-Capacity	0.4

The aforementioned weights (Weight Set 1) reflect the recommendation by the Study Staff's engineering consultants, that the cost of local services is the strongest engineering constraint consideration. Its importance relative to trunk water and sewer systems is reflected in the adopted ratios. The costs of water supply systems and sewage disposal systems are of comparable magnitude to each other. The Highway Construction Cost-Capacity constraint is dependent on characteristics of Provincial highways which may be changed by the Province for reasons beyond the needs of the Sudbury Region alone. Consequently, this constraint has been somewhat downgraded in importance and the Accessibility maps, which more closely reflect regional cost considerations, are given relatively heavy weights. The sum of the weights accorded to all the maps relating to collector and arterial road facilities is about three times the weight of the sewage disposal systems

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(1) See Figure A1

map or the water supply systems map. This ratio is based on a general knowledge of the relative costs for these facilities in other regions than Sudbury.[1] It is also influenced by the consideration that the convenience of accessibility is a significant non-quantifiable locational consideration, in addition to the cost factor.

The relative weight of the Accessibility maps to each other has been determined primarily on the basis of jobs in each of the four centres, but also bearing in mind population distribution and shopping facilities.

Table A-B shows the background data and the relative weights of the four constraint maps suggested by these figures.

TABLE A-B
WEIGHTING OF ACCESSIBILITY MAPS

Centre	1971 Population ('000's)	Estimated Jobs ('000's)	Stores (1966 Census)	Suggested Ratio
Copper Cliff-Creighton	7	11.5	25	.32
Falconbridge-Garson	6	4	10	.11
Levack-Onaping	6	4	10	.11
Sudbury	90	31	554	.86
				1.4

(1) It is emphasized that the weights proposed here are for the purposes of an example only.

III

COMPOSITION AND WEIGHTING OF COMPOSITE 2

Four additional constraints may cause somewhat more varied reactions than the initial set of eight engineering constraints. The importance attached to aircraft noise as a constraint will not appreciably affect the total picture, since the area affected is relatively small. Air Pollution is more controversial, but recent data on pollution counts suggests that pollution should not be a major constraint factor. Given a low weight, it will therefore not strongly influence the pattern on the resultant composite.

The groundwater recharge areas are particularly important if the present sources of water supply are to be protected for the existing developed urban areas. A heavy weight is therefore indicated, unless the decision is taken to abandon these sources and invest in alternative sources. Composite 2 shows the pattern of development areas indicated when Air Pollution, Aircraft Noise, Groundwater and Agricultural Capability are added to Composite 1, with the weights of Table A-C.

TABLE A-C
COMPOSITION AND WEIGHTING OF COMPOSITE 2 MAPS (1)

	Composite 2	Composite 2A	Composite 2B
Air Pollution	0.4	0.4	0.4
Aircraft Noise	1.0	1.0	1.0
Groundwater	2.0	2.0	0.0
Agricultural Capability	2.0	0.0	2.0
Composite 1 Maps	same weights as in Table A-A		

In addition to Composite 2, two variations named 2A and 2B have been produced, to illustrate the results of different emphases on Groundwater and Agricultural Capability. In Composite 2A,

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(1) See Figures A2, A3 and A4.

Agricultural Capability has been ignored but all the other components of Composite 2 have been retained; as a result, this composite map strongly reflects the influence of the heavily weighted Groundwater constraint map. In analogous fashion Composite 2B accentuates the influence of the Agricultural Capability map by giving the Groundwater constraint map a weight of zero.

IV

ANALYSIS

1. Level Distribution

The entire area of the computer maps comprises about 4,800 square miles. One percent of this total area is about 30,000 acres. The examination of the demand for urban land, as described in Schedule "A", has indicated that an area of somewhat less than 10,000 acres would be needed in the next 20 years. From preliminary observation it has been determined that between 60% and 65% of the prime development land would be found to be already developed or else in lie the flood plain. By programming the computer to display the top (i.e. least constrained) one percent of the computer map area as Level One, an area of the order of 30,000 acres x 35% = 9,500 acres could be anticipated to remain after deducting for existing development and flood plain. Some of this land may be found to be unavailable due to an ownership constraint or else it may be in too small an isolated pocket for practical development. Consequently, some of the second best one percent of land area is also likely to be potential urban development land. The focus of the analysis may therefore be placed on these two top levels, which should provide an ample supply of land for the study period.

Composites 1, 2, 2A and 2B have been produced with a spread of 1-1-1-3-94 by cell count, which means that 94% of the total number of cells on the computer map are grouped in Level 5 and the remaining 6% at the top (i.e. least constrained) end of the scale are spread over the other four levels. This choice was made on the grounds that it seemed to best show the lands which are of most interest in the basic planning exercise.

2. Comparison of Composites

The application of the adopted weights has produced four distinct composites, which have some similarities as well as significant differences. Twenty-three general locations have been identified and numbered on Figure A5 and Table A-D.

Table A-E has been drawn up to facilitate a comparison between the various composites. The acreages shown do not include lands in the flood plain or developed areas and they also exclude very small isolated areas which do not fall within any of the twenty three significant locations.

In observing the pattern of the distribution of Level 1 land on all composites, it becomes apparent that other factors than the assumed constraints may have an influence on the practicality of developing different areas of land. Wherever a new water supply or sewage disposal system or trunk main are involved, the size of the area would have a significant bearing on the economics of servicing. It may therefore be more desirable to develop certain Level 2 areas adjoining existing development or next to Level 1 areas planned to be serviced than to attempt to service small pockets of Level 1 land. For this reason, the pattern of Level 2 land should be examined carefully, particularly to determine where it complements areas of Level 1 land.

TABLE A-D
A LIST OF POSSIBLE PRIME AREAS FOR DEVELOPMENT

Area Number for Identification	Location Description and Broad Geographic Grouping Code (1)	
1	Expansion of Lively	(W)
2	Minnow Lake, Sudbury	(S)
3	Infilling in New Sudbury, and expansion north of the boundary	(S)
4	Highway 541, between Sudbury & Garson	(O)
5	Val Caron, north of Whitson Lake	(V)
6	Expansion of Azilda	(V)
7	Expansion of Chelmsford	(V)
8	Expansion of Hanmer to the west and south	(V)
9	Waters Twp. near Highway 17W	(W)
10	The centre of the Valley	(V)
11	East and west of Garson	(O)
12	Broder Twp.near Highways 543 & 69S	(BD)
13	North-east of MacFarlane Lake	(BD)
14	Dill Twp. near Highways 537 & 69S	(BD)
15	Waters Twp. south of Junction Creek	(W)
16	East of Long Lake in Broder Twp.	(BD)
17	Broder-Dill boundary, north of Highway 69S	(BD)
18	North of Falconbridge	(O)
19	Dill Twp. near the golf course on Highway 69S	(BD)
20	North-easterly expansion of Hanmer	(V)
21	North of Coniston	(O)
22	North of Stobie Mine	(O)
23	Sprecher, east of Clara Belle	(S)

(1) Broad geographic groupings are Walden (W), Sudbury (S), Broder-Dill (BD), the Valley (V) and Other (O).

TABLE A-E
SUMMARY OF ACREAGE OF PRIME AREAS FOR DEVELOPMENT ON VARIOUS COMPOSITES

AREA	C O M P O S I T E 1 (Engineering)		C O M P O S I T E 2 (Engineering plus 4 Constraints)		C O M P O S I T E 2A) (Emphasis on Agriculture)		C O M P O S I T E 2B) (Emphasis on Groundwater)	
	Level 1	Level 2	Level 1	Level 2	Level 1	Level 2	Level 1	Level 2
1	250a.	300a.	550a.	-	600a.	-	200a.	150a.
2	600	200	1,100	1,200a.	650	1,200a.	700	550
3	150	50	650	400	100	850	150	600
4	250	-	-	-	150	-	-	-
5	800	150	650	100	750	100	850	300
6	950	150	400	800	250	550	900	150
7	1,700	1,150	-	650	-	700	2,100	850
8	1,450	2,050	300	950	650	1,000	600	250
9	400	50	300	-	300	-	350	100
10	2,400	2,500	950	150	850	200	3,300	2,550
11	400	800	-	-	400	350	-	-
12	450	100	900	100	600	100	600	150
13	50	150	350	-	250	-	200	-
14	-	1,000	850	2,300	850	850	-	1,400
15	150	800	850	50	700	50	150	850
16	-	200	400	-	250	100	-	300
17	50	100	650	-	550	-	150	400
18	-	1,450	50	-	250	1,200	-	100
19	-	-	600	850	-	1,600	-	500
20	100	1,150	-	-	950	350	-	-
21	100	50	-	-	300	-	150	-
22	-	-	900	3,000	-	3,650	-	900
23	-	-	700	-	650	-	-	750
Total	10,250a.	12,400a.	11,200a.	10,550a.	10,050a.	12,850a.	10,400a.	10,850a.

It is clear that the decision to emphasize either or both of the Agricultural Capability and Groundwater maps will have a significant effect on the direction of development in the Region. It is evident from Table A-E, however, that some areas appear as prime development areas on all the composites and should be considered regardless of the major alternatives. This applies to:

Area 1: South-west of Lively.

Area 2: Minnow Lake, particularly toward the east where the terrain is superior for local services.

Area 3: Infilling in New Sudbury, although not much land remains undeveloped.

Area 5: North-west of Whitson Lake, near Val Caron particularly on the east side of Highway 69N.

Area 9: Waters geographic township (Walden), between Highway 17W and the Junction Creek, a small area.

Area 10: The centre of the Valley.

Area 12: Broder geographic township (Sudbury), in the vicinity of Highway 69S and Highway 543.

The total area of the above varies between about 2,000 acres and 3,600 acres depending on the composite chosen.

Table A-F summarizes the general distribution of acreage of Levels 1 and 2 by broad geographic classifications. Clearly, on Composite 1 the overwhelming emphasis is on the Valley, where nearly three quarters of the Level 1 land is located, strongly supported by an almost equal amount of Level 2 land. The introduction of the four additional constraints to produce Composite 2 has a very significant effect in reducing the attractiveness of the Valley. Only the part of Val Caron south of the flood plain retains its favoured position. Although Area 10 still has an appreciable acreage, it is somewhat isolated from existing communities. This composite

suggests a particularly strong thrust into the former Broder-Dill area along Highway 69 South, where large areas of Level 1 and Level 2 lands combine to form a sizeable development area. Certain areas toward the north of the existing built-up area of the city of Sudbury are also relatively attractive for development - toward Stobie Mine and Sprecher - but these are probably only suitable for non-residential uses. Some lands south of the Junction Creek in the former Township of Waters are indicated as Level 1 on Composite 2 and as partially Level 1 and partially Level 2 on the other composites. They may be developable if the economics of providing water and sewerage are favourable in relation to the amount of land available.

If the groundwater map is not included among the constraints, Composite 2A shows a renewed emphasis at the north end of the Valley, around Hanmer and toward Capreol, as well as in the vicinity of Garson. Chelmsford and Azilda remain strongly constrained, however, by virtue of the good agricultural qualities of the surrounding land. Broder-Dill still contains some of the best potential development land, but it does not figure quite as strongly as on Composite 2.

Composite 2B stresses the importance of protecting the groundwater recharge aquifers but ignores the protection of land with good agricultural capability. The resultant pattern now once more strongly emphasizes the Valley, particularly the portion south of the Whitson Creek. Hanmer could only expand in a westerly direction and the lands between Lake Wanapitei and the City of Sudbury are severely constrained. This pattern shows a very strong concentration of development in the Chelmsford-Azilda area.

In summary, about a half dozen areas within and on three sides of the city seem indicated for development, using Weight Set 1, regardless of the emphasis on groundwater or agricultural capability. Only by attaching a strong value to agricultural

capability can any development pattern be justified which does not lay great emphasis on the urbanization of much of the Valley, particularly between Chelmsford and Azilda. If such strong value is attached to the preservation of agricultural land, and if the protection of the groundwater recharge areas is also emphasized, a generally linear development along Highway 69 South is indicated. Without the concern for groundwater, areas such as Hanmer, Capreol and Garson could also receive considerable further development.

Once a basic decision has been taken with respect to the weights of all the constraint maps, an environmental sensitivity analysis may be undertaken of the lands which appear indicated for development on the chosen composite. In addition, relevant factors which had been recognized but deemed unsuitable for inclusion as graded constraints, such as flood plain mapping and land tenure information, should be brought into consideration. In the initial analysis, all flood plain lands had been excluded from consideration, but it seems very likely that existing communities in the flood plain would have to be given special consideration with a view to possibly protecting them by water control schemes. Conversely, although land tenure had not initially been included as a constraint, subsequent investigation may result in otherwise promising areas being excluded on the basis of land tenure and alternative use.

Finally, when all these "sieves" have been used, more detailed planning may be started on the remaining prime lands.

TABLE A-F
GENERAL DISTRIBUTION OF LEVELS 1 AND 2 LANDS ON VARIOUS COMPOSITES

GENERAL LOCATION	COMPOSITE 1 (Engineering)		COMPOSITE 2 (Engineering plus 4 Constraints)		COMPOSITE 2A (Emphasis on Agriculture)		COMPOSITE 2B (Emphasis on Groundwater)	
	Level 1 (acres)	Level 2 (acres)	Level 1 (acres)	Level 2 (acres)	Level 1 (acres)	Level 2 (acres)	Level 1 (acres)	Level 2 (acres)
Sudbury (Areas 2,3,23)	750	250	1,750	1,600	750	2,050	850	1,900
The Valley (Areas 5,6,7,8,10,20)	7,500	7,150	2,300	2,850	3,450	2,900	7,750	4,100
Broder-Dill (Areas 12,13,14,16,17,19)	550	1,550	3,750	3,250	2,500	2,650	950	2,750
Walden (Areas 1,9,15)	800	1,150	1,700	50	1,600	50	700	1,100
Other (Areas 4,11,18,21,22)	750	2,300	1,700	3,000	1,750	5,200	150	1,000
TOTAL	10,350	12,400	11,200	10,750	10,050	12,850	10,400	10,850

ENVIRONMENTAL SENSITIVITY

The analysis of the remaining environmental constraints has been undertaken in two parts:

1) a broad overview of the study area, and
2) a more detailed evaluation of specific potential urban development sites.

The first part is directed at identifying areas that are particularly sensitive throughout the Study Area, independent of the results of the earlier steps in the analysis process. The second part deals specifically with the areas which showed the best potential for development on composites 1, 2, 2A or 2B.

(i) General Environmental Review

The initial overall analysis is based upon the pattern of levels occurring in an Environmental composite incorporating equally-weighted[1] wildlife, fisheries, recreation, vegetation, and scenic features (Composite 3).

Such a composite distributes the entire 4,800-square mile study area among levels as follows:

TABLE A-G
ACREAGE DISTRIBUTION OF LEVELS ON COMPOSITE 3

Level	Area	Percentage of Study Area
1	1,986,789 acres	64.739%
2	543,204 acres	18.678%
3	345,965 acres	11.273%
4	157,198 acres	5.122%
5	5,772 acres	0.188%
	3,038,928 acres	100.00 %

(1) As described in Schedule "C", the levels on these five environmental maps were determined from the number of occurrences of environmental features, without any attempt to judge the relative importance of individual features.

Specific constraints are not identified in this initial overall analysis, but can be isolated if required at a later date.

The most immediate observation arising from the Environmental Composite is the general encirclement of the Regional boundary by heavily constrained land. The mosaic of constraints is most pronounced along the eastern half of the Region, in a broad sweep from Lake Wanapitei southward to the French River and westward to Lake Panache. The lighter pattern of constraints continuing from Lake Panache northward to the Onaping River and eastward to Lake Wanapitei is due in part to a lesser level of information on land in the northwest corner of the study area. The composite therefore reveals strong sensitivity against urban development along most of the Regional boundary especially on the east and south. Conversely, these same lands beyond the boundary exhibit high capabilities for non-urban uses such as forestry, fish and wildlife management; outdoor recreation and other resource/conservation objectives.

A review of lands <u>within</u> the Regional Boundary, reveals the opposite condition in which the western and northern border areas are more heavily constrained, reading as a broad band running from Capreol, through the northern portions of Valley East, Rayside-Balfour, and Onaping Falls to the south-western corner of Walden.

The most common denominator for environmental constraints within the region is the land/water interface along major lake and river corridors. Although the environmental composite has not been directly overlaid with the flood plains map, there is no doubt that a high degree of correlation exists between floodplains and environmentally constrained lands.

Key areas within the Region which exhibit high constraints (level 4 or 5) are listed below:

1. The Levey Creek corridor from Moore Lake to the Vermilion River.
2. The Wanapitei River north of Highway 17 near Timmins Chute.

3. The Ella Lake/Vermilion River area south of Highway 17.
4. Cameron Lake.
5. Post Creek north of Selwyn Lake.

Areas exhibiting moderate environmental constraints (level 3) are as follows:

1. Vermilion River corridor north of Chelmsford.
2. Vermilion Lake.
3. Whitewater Lake.
4. Whitson Creek eastward from Chelmsford.
5. Fairbank Lake.
6. Vermilion River at Levey Creek inflow.
7. Lake Panache and Little Lake Panache.
8. Southeast corner of Dryden Township.

(ii) Review of Potential Prime Development Land

The detailed evaluation concentrates on a list of 23 numbered sites derived from previous analysis of Engineering composites in combination with air pollution, airport noise, agricultural soil capability, and groundwater environments. These sites have been scanned for general environmental constraint categories and specific features and have been charted for ease of review. The chart contains a "Location" column which indicates whether the constraints are contained directly within the site, or within 1 mile of the approximate site boundary. The last column indicates the levels shown on the Environmental composite within or directly adjacent to the site.

Although many of the 23 sites exhibit a large number of specific features, they usually involve the lower levels of the environmental composite due to the lack of actual overlap, or to an array of features limited to one or two categories. Also, certain features such as beaver production capability were not supportable, and were deleted from the Environmental composite. Such features are listed on the chart but are indicated by an asterisk (*).

(iii) Summary

Areas 6, 7, 13 and 14 involve the greatest environmental sensitivity of the 23 sites, but never exceed level 3. Thus we can summarize the charts as indicating that, with four exceptions, those lands which pass through the engineering composites in combination with airport noise, groundwater, agricultural capability and air pollution also pass through the Environmental Composite. As emphasized in the earlier inventory, a more detailed environmental inventory should be made in advance of actual decisions regarding specific sites for urban land development.

It is also important, at the close of this study, to discuss the dual function of Environmental constraints. They not only represent negative limitations against urbanization, as emphasized in this study, but also exist in many cases as positive opportunities for increasing the quality of urban development and life. The negative use of environmental features as constraints must come first, in order to identify and protect such features during the broad evaluation and decision making process regarding urban land use. Subsequent planning efforts, however, in dealing with specific components of urbanization, can look to certain of these "constraints" for potential enhancement of development in the Sudbury region. Thus, a particular site free of internal environmental sensitivity, but existing near a pattern of recreation, scenic and wildlife features, may be selected as being far more suitable for urban residential use than a similar site lacking in any nearby amenities. Such decisions will require a careful evaluation of those constraints which can serve as positive opportunities; those urban land uses which are compatible with the constraints; and the desirable buffer zones, if any, required to protect the resource.

TABLE A-H
SENSITIVITY CHECK OF PRIME AREAS FOR DEVELOPMENT

AREA REFERENCE NUMBER	AREA DESCRIPTION	BASIC CONSTRAINT CATEGORIES (from constraint maps)	SPECIFIC CONSTRAINT FEATURES (from inventory) * = not critical, deleted as constraint	LOCATION Within Site	LOCATION Adjacent to Site (up to 1 mi)	LEVEL (from Env. Const.)
1	expansion of Lively	wildlife	deer production capability*	x		
			moose production capability*	x		
			beaver production capability*	x		
			wetlands		x	
			waterfowl		x	
		recreation	ski hill	x		
			motor tour		x	
			C.L.I. rank 1-4		x	
			bathing beach		x	
			historic site		x	
		fisheries	warm water species		x	1
2	Minnow Lake, Sudbury	wildlife	wetlands		x	
		scenic	land/water margins			
		recreation	C.L.I. class 1-4 lands		x	
			public recreation area		x	
			tourist attractions & motor tours	x		1

AREA REFERENCE NUMBER	AREA DESCRIPTION	BASIC CONSTRAINT CATEGORIES (from constraint maps)	SPECIFIC CONSTRAINT FEATURES (from inventory) * = not critical, deleted as constraint	LOCATION Within Site	LOCATION Adjacent to Site (up to 1 mi.)	LEVEL (from Env. Const.)
3	infilling in New Sudbury and expansion north of the boundary	wildlife	wetlands		x	
			waterfowl		x	
		scenic	land/water margins		x	
		recreation	C.L.I. class 1-4		x	
			public recreation area		x	
			motor tour routes		x	
		fisheries	warm water species		x	1
4	Highway 541 between Sudbury and Garson	wildlife	wetlands		x	
		recreation	public recreation area		x	
			motor tour routes	x		1
5	Northwest of Whitson Lake on both sides of Highway 69N (Val Caron)	wildlife	deer production capability*		x	
			moose production capability*		x	
			wetlands	x		
			waterfowls		x	
		scenic	land/water margins		x	
			hilly slopes		x	
			geomorphological features	x		
			cultural landscapes		x	
		recreation	C.L.I. class 1-4	x		
			water access point	x		
			motor tour routes		x	
			physiographic features	x		
		fisheries	warm water species	x		1 & 2

AREA REFERENCE NUMBER	AREA DESCRIPTION	BASIC CONSTRAINT CATEGORIES (from constraint maps)	SPECIFIC CONSTRAINT FEATURES (from inventory) * = not critical, deleted as constraint	LOCATION Within Site	LOCATION Adjacent to Site (up to 1 mi.)	LEVEL (from Env. Const.)
6	expansion of Azilda	wildlife	deer production capability*	x		
			moose production capability*	x		
			beaver production capability*	x		
			wetlands	x		
			waterfowl	x		
		scenic	land/water margins	x		
			hilly slopes		x	
			cultural landscapes	x		
		recreation	C.L.I. class 1-4	x		
			public recreation areas		x	
			marina		x	
			motor tours	x		
			fishing quality		x	
			bathing beach		x	
			physiographic feature	x		
			ski hill	x		
		fisheries	warm water species	x		1 & 2 & 3
7	expansion of Chelmsford	same as for Area 6				1 & 2 & 3

AREA REFERENCE NUMBER	AREA DESCRIPTION	BASIC CONSTRAINT CATEGORIES (from constraint maps)	SPECIFIC CONSTRAINT FEATURES (from inventory) * = not critical, deleted as constraint	LOCATION Within Site	LOCATION Adjacent to Site (up to 1 mi.)	LEVEL (from Env. Const.)
8	expansion of Hanmer to the west and south	wildlife	deer production capability*	x		
			moose production capability*	x		
			wetlands	x		
			waterfowl	x		
		scenic	land/water margins		x	
			cultural landscapes	x		
		recreation	C.L.I. class 1-4		x	
			FRI recreation potential*		x	
			motor tour	x		
			canoe route		x	
			bathing beach		x	
			physiographic feature		x	
		vegetation	low yield timber		x	
			protection forest		x	1 & 2
9	Waters Township near Highway 17 W	wildlife	deer production capability*	x		
			moose production capability*	x		
			beaver production capability	x		
			waterfowl	x		
		scenic	land/water margins	x		
			hilly steep slopes		x	
		recreation	ski hill		x	1

AREA REFERENCE NUMBER	AREA DESCRIPTION	BASIC CONSTRAINT CATEGORIES (from constraint maps)	SPECIFIC CONSTRAINT FEATURES (from inventory) * = not critical, deleted as constraint	LOCATION Within Site	LOCATION Adjacent to Site (up to 1 mi.)	LEVEL (from Env. Const.)
10	the centre of The Valley	wildlife	deer production capability*	x		
			moose production capability*	x		
			beaver production capability*	x		
			wetlands	x		
			waterfowl	x		
		scenic	cultural landscapes		x	
		recreation	C.L.I. class 1-4	x		
			motor tour route	x		
			bathing beach	x		
		fisheries	warm water species	x		1 & 2
11	East and West of Garson	wildlife	wetlands	x		
			waterfowl	x		
		recreation	public recreation areas	x		
			tourist attractions and motor tour routes	x		
			ski hills	x		1 & 2
12	Broder Township, near Highways 543 and 69S	wildlife	deer production capability*	x		
			moose production capability*	x		
			beaver production capability*	x		
		scenic	land/water margins		x	
			hilly	x		
		recreation	C.L.I. class 1-4	x		
			motor tour routes		x	
			bathing beach	x		
			ski hill	x		1

AREA REFERENCE NUMBER	AREA DESCRIPTION	BASIC CONSTRAINT CATEGORIES (from constraint maps)	SPECIFIC CONSTRAINT FEATURES (from inventory) * = not critical, deleted as constraint	LOCATION Within Site	LOCATION Adjacent to Site (up to 1 mi.)	LEVEL (from Env. Const.)
13	North-east of MacFarlane Lake	wildlife	wetlands	x		
		scenic	land/water margins	x		
			hilly	x		
		recreation	C.L.I. class 1-4	x		
			motor tour routes	x		
		vegetation	unique vegetation	x		1 & 2 & 3
14	Dill Township near Highways 537 and 69S	wildlife	deer production capability*	x		
			moose production capability*	x		
			beaver production capability	x		
			wetlands	x		
		scenic	land/water margins	x		
			hilly		x	
			cultural landscapes	x		
		recreation	F.R.I. recreation potential*	x		
			motor tour routes	x		
			collecting and gathering area		x	
		vegetation	production timber stands		x	
			low yield timber	x		
			protection forest	x		
		fisheries	warm water species	x		1 & 2 & 3

AREA REFERENCE NUMBER	AREA DESCRIPTION	BASIC CONSTRAINT CATEGORIES (from constraint maps)	SPECIFIC CONSTRAINT FEATURES (from inventory) * = not critical, deleted as constraint	LOCATION Within Site	LOCATION Adjacent to Site (up to 1 mi.)	LEVEL (from Env. Const.)
15	Waters Township, South of Junction Creek	wildlife	deer production capability*	x		
			moose production capability*	x		
			beaver production capability	x		
		scenic	land/water margins	x		
			hilly		x	
		recreation	C.L.I. class 1-4	x		1
16	East of Long Lake in Broder Township	wildlife	moose production capability*		x	
			beaver production capability*	x		
			wetlands		x	
		scenic	land/water margins	x		
			hilly	x		
		recreation	C.L.I. class 1-4		x	
			bathing beach		x	1
17	Broder-Dill, North of Highway 69S, near Perch Lake	wildlife	wetlands		x	
			waterfowl	x		
		scenic	land/water margins	x		
			hilly	x		
		recreation	C.L.I. class 1-4	x		
			public recreation area	x		
			motor tour routes		x	1 & 2

AREA REFERENCE NUMBER	AREA DESCRIPTION	BASIC CONSTRAINT CATEGORIES (from constraint maps)	SPECIFIC CONSTRAINT FEATURES (from inventory) * = not critical, deleted as constraint	LOCATION Within Site	LOCATION Adjacent to Site (up to 1 mi.)	LEVEL (from Env. Const.)
18	North of Falconbridge	wildlife	wetlands	x		
			waterfowl		x	
		scenic	geomorphological features	x		
		recreation	C.L.I. class 1-4		x	
			tourist attractions		x	
			ski hills		x	
		fisheries	warm water species	x		1 & 2
19	Dill Township, near the golf course on Highway 69S	wildlife	wetlands		x	
		scenic	land/water margins		x	
			hilly		x	
			cultural landscape		x	
		recreation	motor tour		x	
			collecting and gathering areas		x	1
20	North-easterly expansion of Hanmer	scenic	land/water margins	x		
			hilly		x	
		recreation	C.L.I. class 1-4	x		
			F.R.I. recreation potential*	x		
			motor tour route		x	
			canoe route	x		
			ski hill	x		1

AREA REFERENCE NUMBER	AREA DESCRIPTION	BASIC CONSTRAINT CATEGORIES (from constraint maps)	SPECIFIC CONSTRAINT FEATURES (from inventory) * = not critical, deleted as constraint	LOCATION Within Site	LOCATION Adjacent to Site (up to 1 mi.)	LEVEL (from Env. Const.)
21	North of Coniston	wildlife	wetlands	x		1
22	North of Stobie Mine	wildlife	waterfowl		x	
		recreation	motor tour routes		x	
		fisheries	warm water	x		1 & 2
23	Sprecher, East of Clara Belle	recreation	public recreation areas	x		
			motor tour routes		x	
			historic site		x	
			physiographic features	x		
		fisheries	warm water species	x		1

APPENDIX

1. GLOSSARY OF TERMS

2. LIST OF CONSTRAINT MAPS WITH RATINGS

APPENDIX 1

GLOSSARY OF TERMS

Constraint and Constraint Map

A constraint is a factor influencing the suitability of land for urban development. Such factors can be expressed in relative terms, denoting the severity of the constraint ranging from no constraint to maximum constraint.

A constraint map is a map illustrating the variations in a particular constraint factor throughout the Study Area.

Constraint Level and Rating

Each constraint map shows the study area divided into areas of different levels of constraint. These levels are given a "rating" denoting the relative degree of constraint ascribed to each level. The maximum rating on the map is unity and the other levels are rated as decimal portions of unity, including zero, where the degree of constraint is insignificant.

Weighting

Each constraint map is given a "weight" denoting its relative importance in comparison with the other constraints being considered. Where all constraints are considered equally important, as in the environmental series, they are each given the weight of one.

Weight Set

A set of weights used to produce a composite is defined as a "weight set". Each unique set is given a number for identification.

Composite

A composite is a map produced by the computer combining two or

more constraint maps with the weights and ratings assigned by the user.

Identification of composite maps should include the weight set number, the composite number which determines the constituent constraint maps and the spread, which determines how the cells are divided into levels on the composite.

Composite 1

The Engineering Composite, comprised of the eight maps listed in Table A-A, is designated as Composite 1.

Composite 2

Composite 2 is made up of Composite 1, augmented by the following four maps:

Aircraft Noise
Air Pollution
Agricultural Capability
Groundwater

Variations of Composite 2, excluding one or more of the above four maps, are designated as Composite 2A (excluding Groundwater) and Composite 2B (excluding Agricultural Capability).

Composite 3

An Environmental Composite which aggregates the five groups of environmental maps (Wildlife, Fisheries, Scenic, Recreation and Vegetation) is designated as Composite 3.

Score

Each cell on a Constraint map obtains a score which is the product of its rating and the weight of the map. On a Composite, the score is the sum of the scores on each of the constituent constraint maps.

Spread

- Division according to scores
- Division according to cell counts

On each composite map, the computer program determines the score for each cell and subsequently divides the interval between the maximum score and the minimum score on the map into five equal levels (Division according to scores). Each cell is then printed with a symbol denoting the level into which it falls by virtue of its score. The spread for this standard division into levels would be described as 20-20-20-20-20 or 5 x 20, referring to the percentage distribution for each level. In order to permit fine analysis, a modification of the program permits the user to specify any spread he desires. For instance 20-10-10-10-10-40 divides the interval into six levels and permits finer analysis in the middle of the spectrum. Alternatively, the program provides for a division into levels based on a specified percentage of cells to be included in each level. A 5 x 20 cell count spread would divide the number of cells in the Study Area by five and there would be an equal number of cells in each level.

APPENDIX 2

CONSTRAINT MAPS WITH RATINGS

CONSTRAINT MAP	RATINGS									
Levels	1	2	3	4	5	6	7	8	9	10
AIRCRAFT NOISE	0.00	0.56	0.67	0.78	1.00	-	-	-	-	-
AIR POLLUTION	0.00	0.40	0.60	0.70	1.00	-	0.40	-	-	-
AGRICULTURAL CAPABILITY	0.00	0.40	0.60	0.80	1.00	-	-	-	-	
ACCESSIBILITY TO SUDBURY	0.10	0.20	0.40	0.70	1.00	-	-	-	-	-
LOCAL SERVICES	0.30	0.40	0.50	0.60	1.00	-	-	-	-	-
WATER SUPPLY SYSTEMS	0.10	0.30	0.30	0.60	0.80	1.00	-	-	-	-
SEWAGE DISPOSAL SYSTEMS	0.10	0.20	0.20	0.40	0.78	1.00	-	-	-	-
HIGHWAY COST CAPACITY	0.50	0.84	0.53	0.95	0.91	0.85	1.00	-	-	-
ACCESSIBILITY TO COPPER CLIFF	0.10	0.20	0.40	0.70	1.00	-	-	-	-	-
ACCESSIBILITY TO LEVACK	0.10	0.20	0.40	0.70	1.00	-	-	-	-	-
ACCESSIBILITY TO FALCONBRIDGE	0.10	0.20	0.40	0.70	1.00	-	-	-	-	-
WILDLIFE	0.20	0.40	0.60	0.80	1.00	-	-	-	-	-
FISHERIES	0.20	0.40	0.60	0.80	1.00	-	-	-	-	-
RECREATION	0.20	0.40	0.60	0.80	1.00	-	-	-	-	-
VEGETATION	0.20	0.40	0.60	0.80	1.00	-	-	-	-	-
SCENIC FEATURES	0.20	0.40	0.60	0.80	1.00	-	-	-	-	-

FIG A1

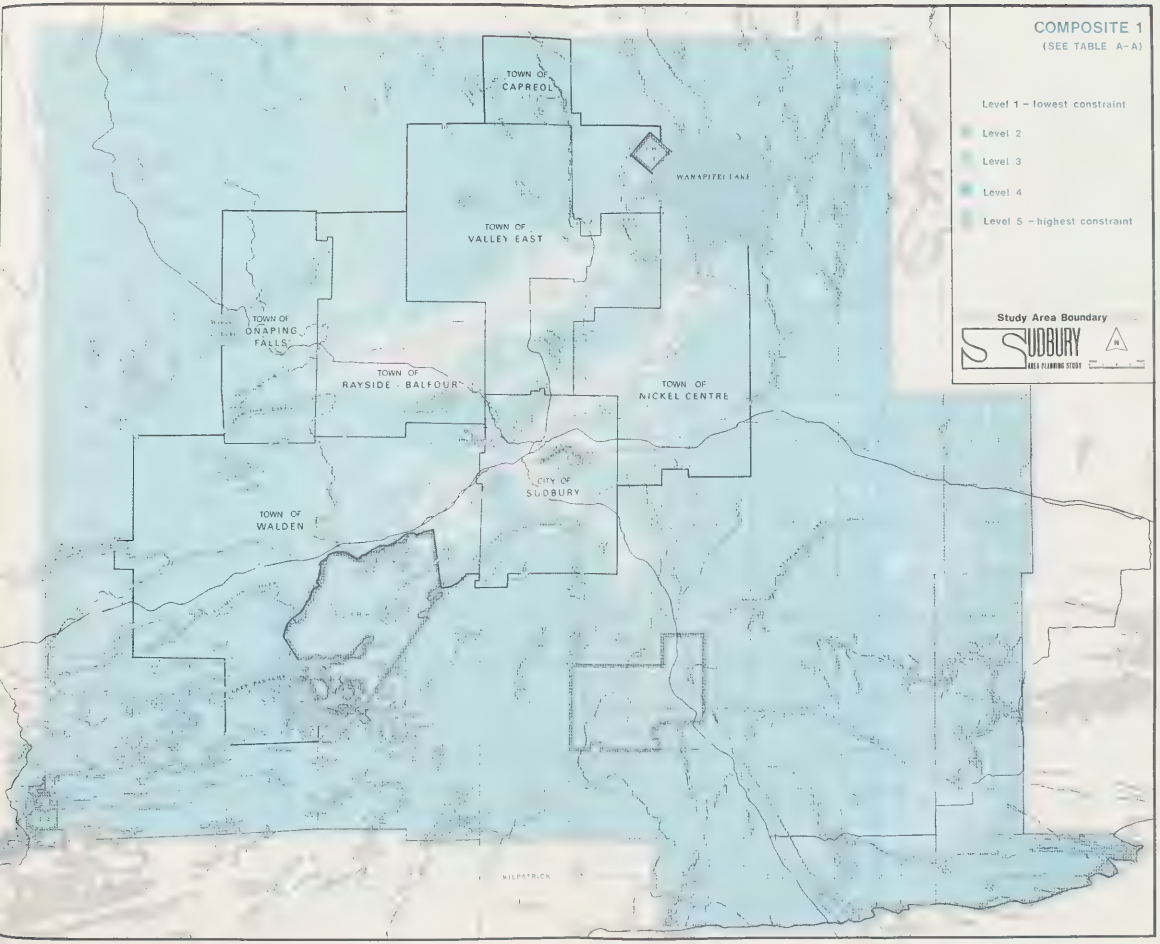

COMPOSITE 1
(SEE TABLE A-A)
Level 1 – lowest constraint
Level 2
Level 3
Level 4
Level 5 – highest constraint
Study Area Boundary
SUDBURY AREA PLANNING STUDY
TOWN OF CAPREOL
WANAPITEI LAKE
TOWN OF VALLEY EAST
TOWN OF ONAPING FALLS
TOWN OF RAYSIDE - BALFOUR
TOWN OF NICKEL CENTRE
CITY OF SUDBURY
TOWN OF WALDEN
LONG LAKE
KILPATRICK

FIG. A2

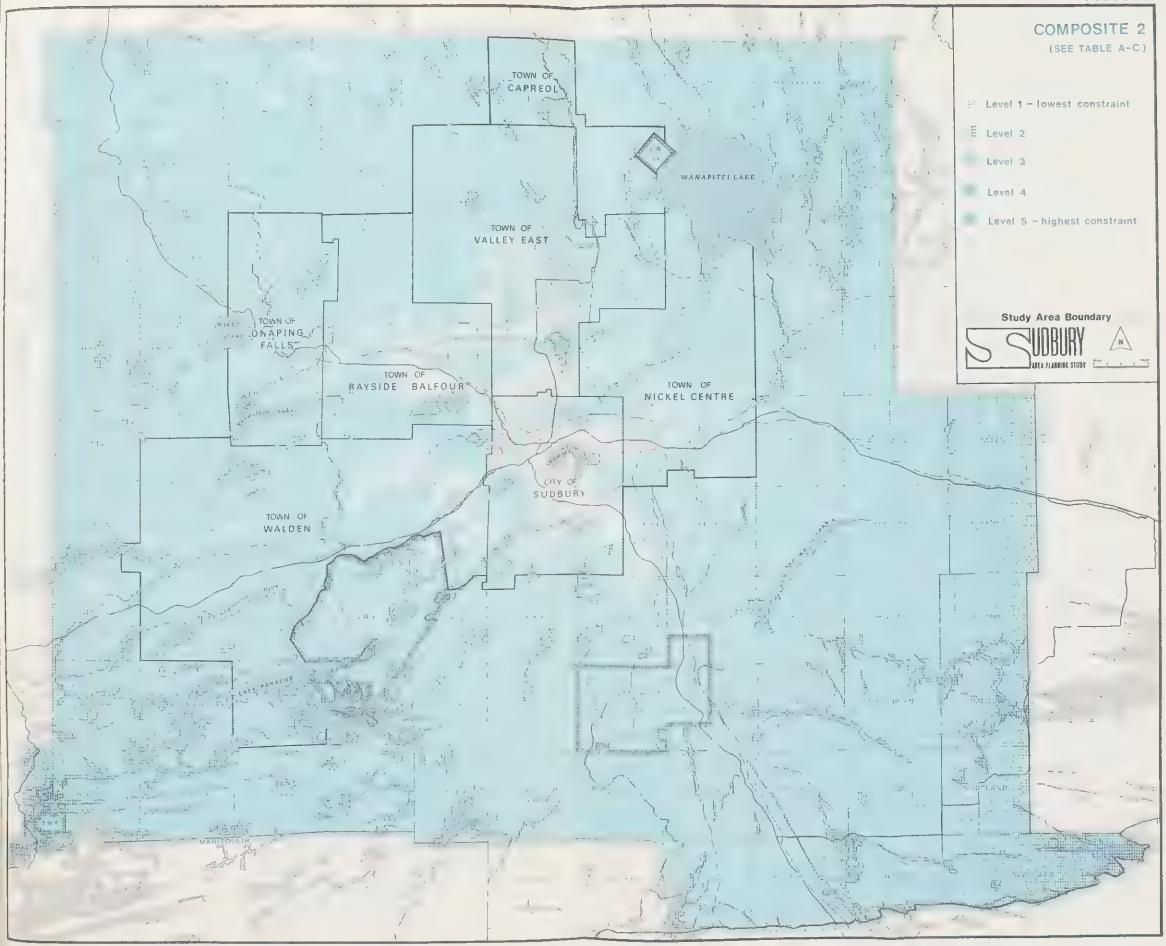

COMPOSITE 2
(SEE TABLE A-C)
Level 1 – lowest constraint
Level 2
Level 3
Level 4
Level 5 – highest constraint
Study Area Boundary
SUDBURY
AREA PLANNING STUDY
TOWN OF CAPREOL
WANAPITEI LAKE
TOWN OF VALLEY EAST
TOWN OF ONAPING FALLS
TOWN OF RAYSIDE BALFOUR
TOWN OF NICKEL CENTRE
CITY OF SUDBURY
TOWN OF WALDEN
WANAPITEI R.

FIG. A3

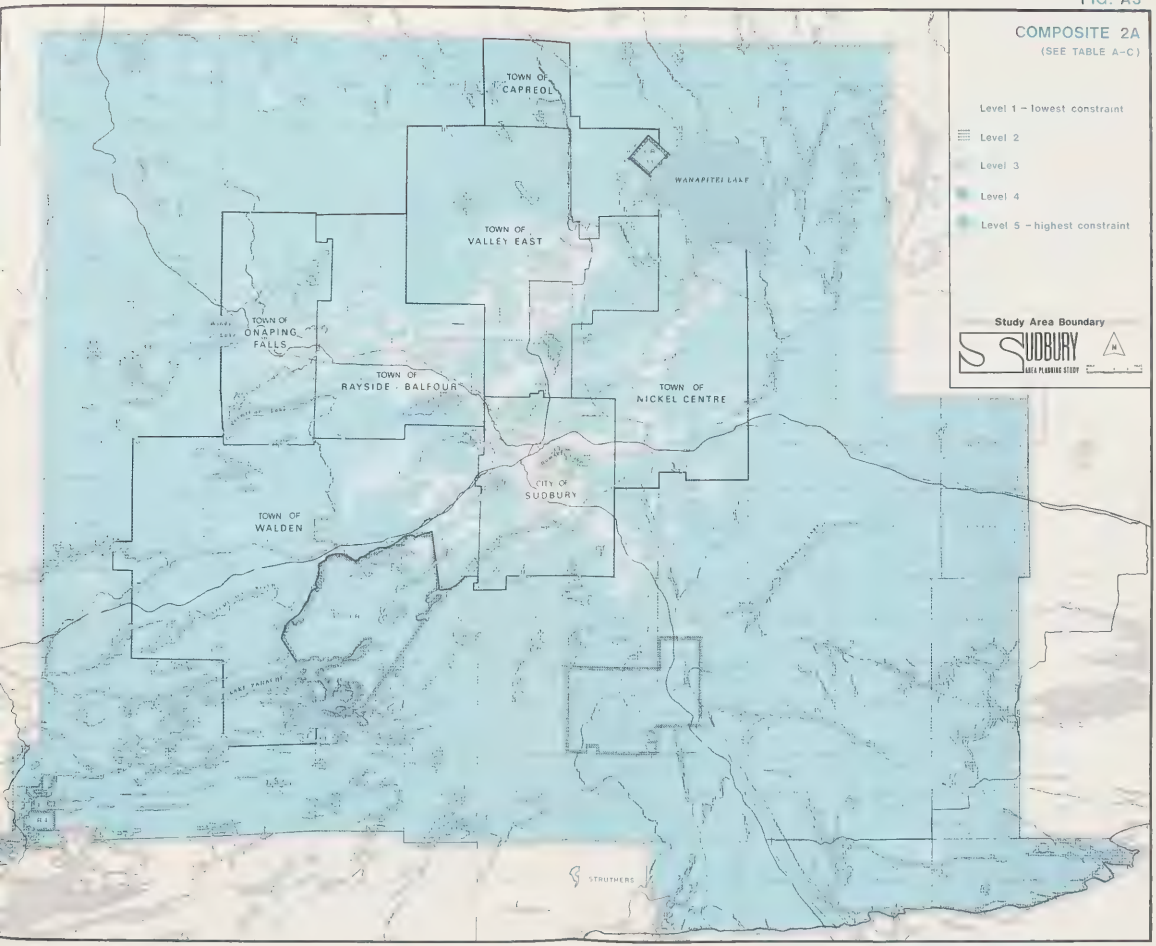

COMPOSITE 2A
(SEE TABLE A-C)
Level 1 – lowest constraint
Level 2
Level 3
Level 4
Level 5 – highest constraint
Study Area Boundary
SUDBURY
AREA PLANNING STUDY
TOWN OF CAPREOL
WANAPITEI LAKE
TOWN OF VALLEY EAST
TOWN OF ONAPING FALLS
TOWN OF RAYSIDE - BALFOUR
TOWN OF NICKEL CENTRE
CITY OF SUDBURY
TOWN OF WALDEN
STRUTHERS

FIG. A4

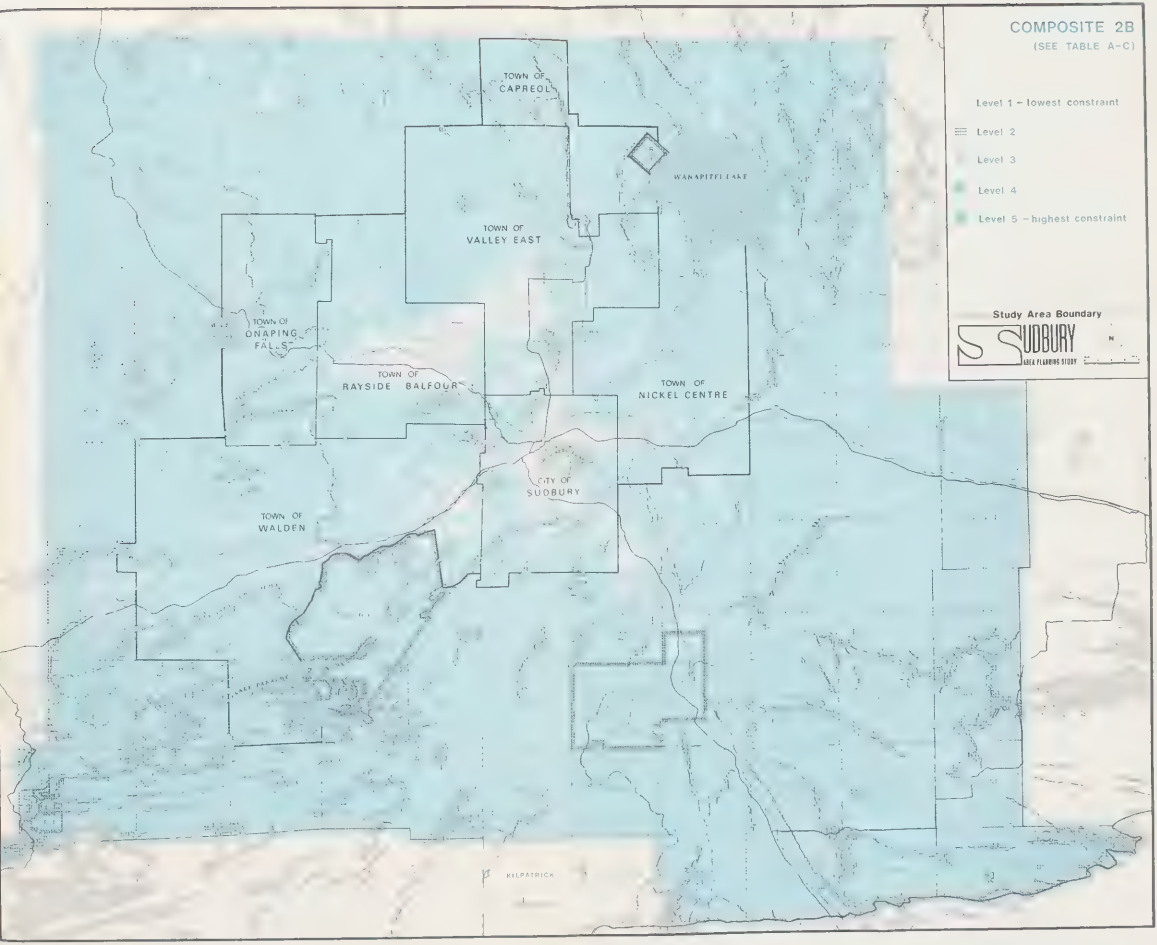

COMPOSITE 2B
(SEE TABLE A-C)
Level 1 – lowest constraint
Level 2
Level 3
Level 4
Level 5 – highest constraint
Study Area Boundary
SUDBURY
AREA PLANNING STUDY
N
TOWN OF CAPREOL
WANAPITEI LAKE
TOWN OF VALLEY EAST
TOWN OF ONAPING FALLS
TOWN OF RAYSIDE BALFOUR
TOWN OF NICKEL CENTRE
CITY OF SUDBURY
TOWN OF WALDEN
KILPATRICK

FIG. A5

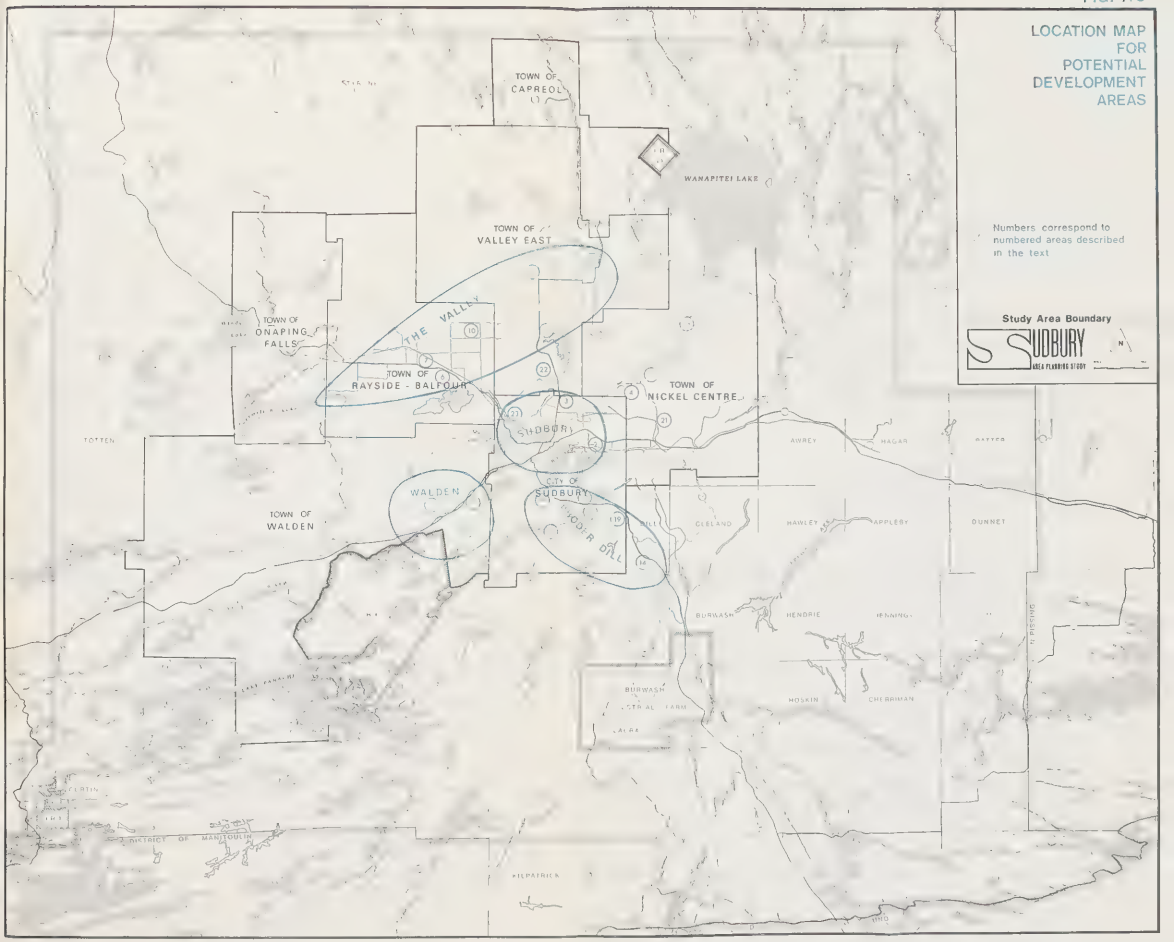
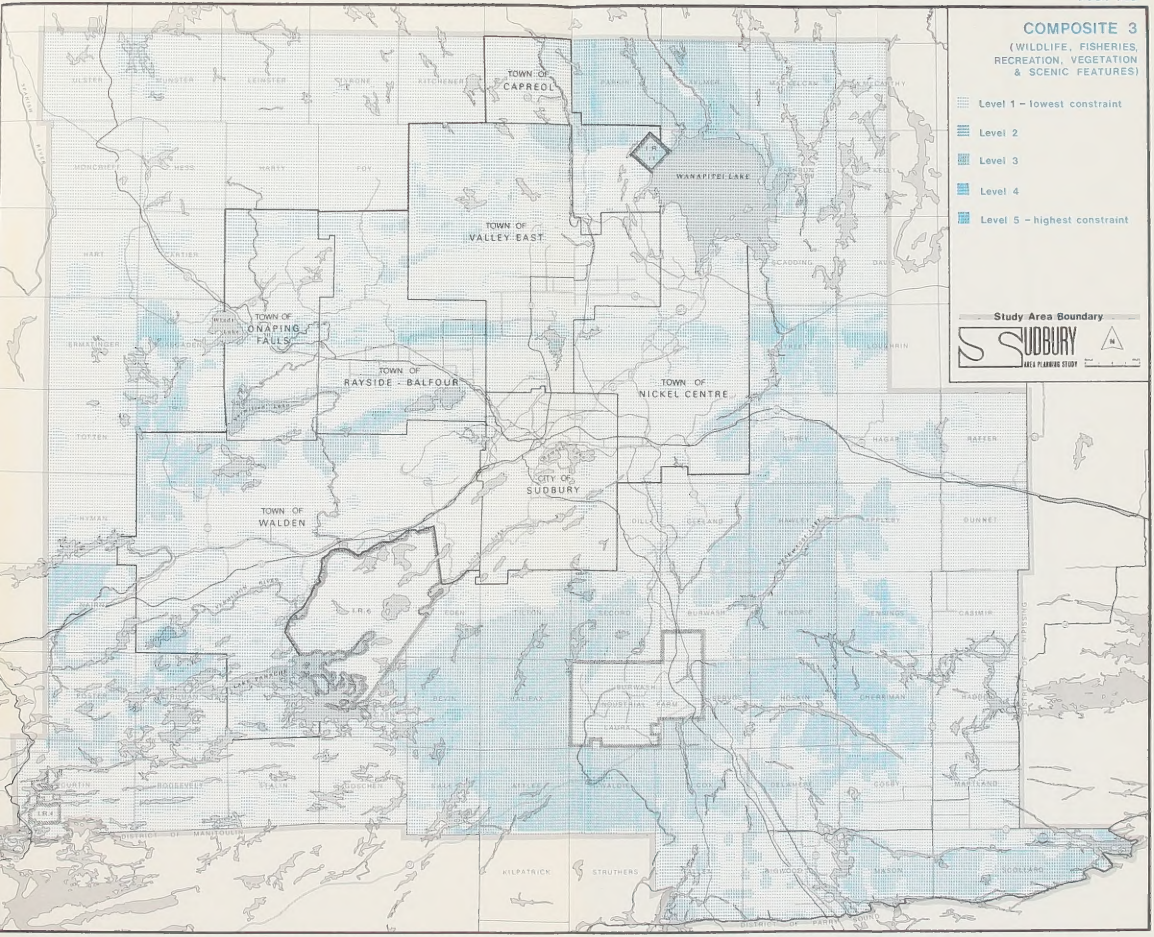

LOCATION MAP FOR POTENTIAL DEVELOPMENT AREAS
Numbers correspond to numbered areas described in the text
Study Area Boundary
SUDBURY AREA PLANNING STUDY
TOWN OF CAPREOL
WANAPITEI LAKE
TOWN OF VALLEY EAST
THE VALLEY
TOWN OF ONAPING FALLS
TOWN OF RAYSIDE - BALFOUR
TOWN OF NICKEL CENTRE
SUDBURY
CITY OF SUDBURY
WALDEN
TOWN OF WALDEN
TOTTEN
AWREY
HAGAR
CLELAND
HAWLEY
APPLEBY
DUNNET
BURLASH
HENDRIE
HENNING
MOSKIN
CHERRIMAN
DISTRICT OF MANITOULIN
FITZPATRICK

FIG. A6


COMPOSITE 3
(WILDLIFE, FISHERIES, RECREATION, VEGETATION & SCENIC FEATURES)
Level 1 – lowest constraint
Level 2
Level 3
Level 4
Level 5 – highest constraint
Study Area Boundary
SUDBURY
AREA PLANNING STUDY
TOWN OF CAPREOL
WANAPITEI LAKE
TOWN OF VALLEY EAST
TOWN OF ONAPING FALLS
TOWN OF RAYSIDE - BALFOUR
TOWN OF NICKEL CENTRE
CITY OF SUDBURY
TOWN OF WALDEN
KILPATRICK
STRUTHERS